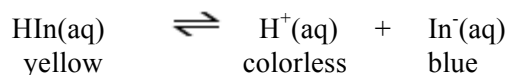


Determination of Equilibrium Constant of an Indicator: Sample Calculations

The green color of the indicator is due to the mixture of yellow protonated indicator (HIn) and blue conjugate base (In⁻).



Measuring Absorbances (615 nm)

Sample student data for this experiment:

4.00 mL of $5.0 \times 10^{-5} M$ bromocresol green and 4.00 mL of other solutions listed.

Sample: (indicator and ...)	Absorbance at 615 nm
HCl	0.013
NaOH	1.015
pH 4.0 buffer	0.168
Unknown Buffer	0.339

Calculations:

Using Beer's Law ($A = \epsilon l C$ or $A = abC$), the total absorbance is the sum of the contributions from each component HIn and In⁻.

$$\begin{aligned} A_{\text{total}} &= A_{\text{HIn}} + A_{\text{In}^-} \\ \text{Thus,} \\ A_{\text{total}} &= \epsilon_{\text{HIn}} l [\text{HIn}] + \epsilon_{\text{In}^-} l [\text{In}^-] \end{aligned}$$

Rewritten in the AP exam format:

$$A_{\text{total}} = ab_{\text{HIn}} [\text{HIn}] + ab_{\text{In}^-} [\text{In}^-]$$

Calculating ab_{HIn} using HCl Sample Absorbance:

Calculating ab_{In^-} using NaOH Sample Absorbance:

Calculations of K_{In} of bromocresol green using known buffer sample:

Calculations of pH of unknown buffer: